

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: January 20, 2022

TO: Sean Spencer – SCR/Fitchburg

FROM: Sarah Luck – SCR/Fitchburg

SUBJECT: Water Quality-Based Effluent Limitations for the Wisconsin Dells-Lake Delton Sewerage Commission WWTF
WPDES Permit No. WI-0031402-08

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the Wisconsin Dells-Lake Delton Sewerage Commission WWTF in Columbia County. This municipal wastewater treatment facility (WWTF) discharges to the Wisconsin River in the Duck Creek Watershed (LW25) of the Lower Wisconsin River Basin. This discharge is included in the Wisconsin River TMDL as approved by EPA on April 26, 2019 with site-specific criteria approved by EPA on July 9, 2020. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Footnotes
Flow Rate					1,2
BOD ₅			45 mg/L	30 mg/L	2
TSS			45 mg/L	30 mg/L	2
pH	9.0 s.u.	6.0 s.u.			2
Ammonia Nitrogen					1,2
Bacteria					3
Interim Limit Fecal Coliform				400 #/100 mL geometric mean	3
Final Limit <i>E. coli</i>				126 #/100 mL geometric mean	
Mercury					4
Phosphorus					5
TBEL				1.0 mg/L	5
TMDL				14 lbs/day	
Zinc					6
TKN, Nitrate+Nitrite, and Total Nitrogen					1,2
Acute WET					7

Footnotes:

1. Monitoring only.
2. No changes from the current permit.
3. Bacteria limits apply during the disinfection season of May through September. The fecal coliform interim limit will apply until the end of the compliance schedule when *E. coli* limits take

effect. Additional final limit: No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 count/100 mL.

4. Quarterly monitoring along with continued pollutant minimization efforts and a report on status submitted at least six months prior to the next permit expiration date.
5. The phosphorus mass limit is based on the Total Maximum Daily Load (TMDL) for the Wisconsin River Basin to address phosphorus water quality impairments within the TMDL area. The TMDL limit based on site-specific criteria is 14 lbs/day as a monthly average. The concentration limit of 1.0 mg/L, based on the technology-based effluent limit (TBEL), should be retained to prevent backsliding.
6. Monitoring at a frequency to ensure that a minimum of 11 samples are available at the next permit issuance.
7. Annual acute WET monitoring is required. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Tests should be done in rotating quarters, to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).

The recommended limits meet the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, and additional limits are not required.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Sarah Luck (Sarah.Luck@wisconsin.gov) or Diane Figiel (Diane.Figiel@wisconsin.gov).

Attachments (3) – Narrative, Site Map, and Ammonia Nitrogen Calculations

PREPARED BY:



Sarah Luck
Water Resources Engineer

Date: January 20, 2022

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**Water Quality-Based Effluent Limitations for
Wisconsin Dells-Lake Delton Sewerage Commission WWTF**

WPDES Permit No. WI-0031402-08

Prepared by: Sarah Luck

PART 1 – BACKGROUND INFORMATION

Facility Description

The Wisconsin Dells – Lake Delton Sewerage Commission owns and operates a wastewater treatment facility that treats the wastewaters generated by in the communities of the City of Wisconsin Dells and the Village of Lake Delton. Wastewater is pumped to the wastewater treatment facility through separate force mains from each community. It is metered, sampled and reported separately. Discharge is significantly higher during the summer months due to seasonal tourists. Treatment consists of a screening/grit chamber which removes debris and gravel from the untreated wastewater (influent). The influent then enters aeration tanks where it is aerated, mixed, or bypassed depending on the treatment needed and is followed by treatment in an aerated oxidation ditch. After the oxidation ditch, chemical (alum) additions are made to remove phosphorus. The treated wastewater (effluent) is sent to one of four final clarifiers where remaining solids are settled out and passed through ultraviolet disinfection (May through September) prior to discharge to the Wisconsin River.

Attachment #2 is a map of the area showing the approximate location of Outfall 001.

Existing Permit Limitations

The current permit, expiring on March 31, 2022, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Footnotes
Flow Rate					1
BOD ₅			45 mg/L	30 mg/L	2
TSS			45 mg/L	30 mg/L	2
pH	9.0 s.u.	6.0 s.u.			2
Ammonia Nitrogen					1
Fecal Coliform May – September			656#/100 mL geometric mean	400#/100 mL geometric mean	-
Mercury	6.6 ng/L				3
Phosphorus				1.0 mg/L	-
TKN, Nitrate+Nitrite, and Total Nitrogen					1
WET					4

Footnotes:

1. Monitoring only.
2. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
3. This is an alternative effluent limitation in place of the WQBEL since the facility has an approved mercury variance. A compliance schedule is in the current permit to meet the final WQBEL by March 31, 2022.
4. Annual acute WET testing.

Receiving Water Information

- Name: Wisconsin River
- Waterbody Identification Code (WBIC): 1179900
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q₁₀ and 7-Q₂ values are from the U.S. Geological Survey based on flow information obtained from the Wisconsin River at Wisconsin Dells, dated 1/21/2003, where Outfall 001 is located.
 - 7-Q₁₀ = 1790 cfs (cubic feet per second)
 - 7-Q₂ = 2750 cfs
 - 90-Q₁₀ = 2380 cfs
 - Harmonic Mean Flow = 4830 cfs
- Hardness = 75 mg/L as CaCO₃. This value represents the geometric mean of data from 1990-1992 (n=10) from SWIMS Station 573052.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: 25%
- Source of background concentration data: Metals data from the Wisconsin River at the Wisconsin Dells (SWIMS Station 573052) is used for this evaluation. The numerical values are shown in the tables below. If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations.
- Multiple dischargers: There are several other dischargers to the Wisconsin River; however, they are not in the immediate vicinity and the mixing zones do not overlap. Therefore, the other dischargers do not impact this evaluation.
- Impaired water status: The Wisconsin River is listed as impaired for total phosphorus (4/1/1998) at the point of discharge and is included in the 2019 approved Wisconsin River TMDL addressing total phosphorus and total suspended solids.

Effluent Information

- Flow rates:
 - Design annual average = 2.73 MGD (Million Gallons per Day)
 - Peak daily = 5.0 MGD
 - Peak monthly = 4.4 MGD
 - For reference, the actual average flow from May 2017 through November 2021 was 1.54 MGD.
- Hardness = 107 mg/L as CaCO₃. This value represents the geometric mean of data from February 2021 (n=4) reported on the permit application.
- Acute dilution factor used in accordance with s. NR 106.06(3)(c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water source: Domestic wastewater with water supply from wells.

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- Additives: Alum (phosphorus removal)
- Total Phosphorus Wasteload Allocation (site specific): 3,045 lbs/year = 8 lbs/day (see Appendix K of the TMDL document).
- Effluent characterization: This facility is categorized as a major municipal, so the permit application required effluent sample analyses for all the “priority pollutants” except for the Dioxins and Furans as specified in s. NR 200.065, Table 1, Wis. Adm. Code. The permit-required monitoring for mercury from July 2017 through October 2021 is also used in this evaluation.
- Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled “MEAN EFFL. CONC.”. Otherwise, substances with multiple effluent data are shown in the tables below or in their respective parts in this evaluation.

Sample Date	Copper µg/L	Sample Date	Copper µg/L	Sample Date	Copper µg/L
01/11/2021	<11	01/23/2021	<11	02/04/2021	<11
01/14/2021	<11	01/26/2021	<11	02/07/2021	<11
01/17/2021	<11	01/29/2021	<11	02/10/2021	<11
01/20/2021	<11	02/01/2021	<11		
Mean = <11 µg/L					

“<” means that the pollutant was not detected at the indicated level of detection.

Sample Date	Chloride mg/L
02/01/2021	89
02/04/2021	94
02/07/2021	98
02/10/2021	86
Mean	92 mg/L

July 2017 – October 2021	Mercury ng/L
1-day P ₉₉	2.4
4-day P ₉₉	1.5
30-day P ₉₉	1.0
Mean	0.79
Std	0.46
Sample size	18
Range	0.36 - 2.3

The following table presents the average concentrations and loadings at Outfall 001 from May 2017 through November 2021 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6), Wis. Adm. Code:

Averages of Parameters with Limits

	Average Measurement
BOD ₅	5 mg/L*
TSS	3 mg/L*
pH field	7.2 s.u.
Phosphorus	0.15 mg/L

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	Average Measurement
Mercury	0.79 ng/L

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P₉₉) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q₁₀

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code, (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q₁₀ receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards. The mass balance equation is provided below.

$$\text{Limitation} = \frac{(\text{WQC}) (Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)}{Q_e}$$

Where:

WQC = Acute toxicity criterion or secondary acute value according to ch. NR 105, Wis. Adm. Code.

Q_s = average minimum 1-day flow which occurs once in 10 years (1-day Q₁₀)

if the 1-day Q₁₀ flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q₁₀).

Q_e = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

C_s = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e), Wis. Adm. Code.

If the receiving water is effluent dominated under low stream flow conditions, the 1-Q₁₀ method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is not the case for Wisconsin Dells-Lake Delton Sewerage Commission WWTF, and the limits are set based on two times the acute toxicity criteria.

The following tables list the calculated WQBELs for this discharge along with the results of effluent sampling. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness, chloride (mg/L), and mercury (ng/L).

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Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 1432 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD. mg/L	ATC	MEAN BACK- GRD.	MAX. EFFL. LIMIT*	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Arsenic		340		680	135.9	<4.7		
Cadmium	107	11.1	0.013	22.2	4.4	<0.42		
Chromium	107	1900		3800	760	1.7		
Copper	107	16.5	0.844	33.0	6.3	<11		
Lead	107	114		227.5	45.5	<1.4		
Mercury (ng/L)		830	2.51	1660			2.4	2.3
Nickel	107	495		990.5	198	2.2		
Zinc	107	127	1.826	254	50.2		87.8**	70.5
Chloride (mg/L)		757	14.9	1514	303	91.8		

* The 2 × ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q₁₀ flow rates per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016.

** See discussion below tables.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 447 cfs (¼ of the 7-Q₁₀), as specified in s. NR 106.06(4)(c), Wis. Adm. Code

SUBSTANCE	REF. HARD. mg/L	CTC	MEAN BACK- GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Arsenic		152.2		16276	3255.3	<4.7	
Cadmium	75	1.96	0.013	208.23	41.6	<0.42	
Chromium	75	104.38		11163	2232.5	1.7	
Copper	75	8.09	0.844	775.7	155.15	<11	
Lead	75	21.21		2268.2	453.6	<1.4	
Mercury (ng/L)		440	2.51	46788			1.5
Nickel	75	40.92		4376	875.2	2.2	
Zinc	75	93.61	1.826	9817	1963.5		68.8
Chloride (mg/L)		395	14.9	40663	8133	91.8	

Monthly Average Limits based on Wildlife Criteria (WC)

RECEIVING WATER FLOW = 584 cfs (¼ of the 90-Q₁₀), as specified in s. NR 106.06(4), Wis. Adm. Code

SUBSTANCE	WC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	30-day P ₉₉
Mercury (ng/L)	1.3	2.51	1.3	1.0

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Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 1207 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P ₉₉
Cadmium	370	0.013	106136	21227.2	<0.42	
Chromium (+3)	3818000		1095244696	219048939	1.7	
Lead	140		40161	8032.2	<1.4	
Mercury (ng/L)	1.5	2.51	1.5			1.0
Nickel	43000		12335129	2467026	2.2	
Hexachlorobenzene	0.075		21.515	4.303	0.018	

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 1207 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HCC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3	3815.3	763.1	<4.7

In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because no effluent limits are needed based on HCC, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations

Based on a comparison of the effluent data and calculated effluent limitations, **effluent limitations are not required.**

Zinc – A single zinc sample was reported on the 2021 permit application. This value (58.9 µg/L) exceeds 1/5th of the acute toxicity criteria (50.9 µg/L) which is used to determine the need to include a limit per s. NR 106.05(6), Wis. Adm. Code. However, at the last permit issuance, a similar result of 54.7 ug/L was reported on the 2016 permit application and so an additional 12 samples were collected. All samples are shown in the table below.

Sample Date	Zinc µg/L	Sample Date	Zinc µg/L	Sample Date	Zinc µg/L
06/25/2014	54.7	12/14/2015	70.5	12/30/2015	56.4
11/30/2015	44.6	12/16/2015	34.7	01/04/2015	50.2
12/02/2015	52.1	12/21/2015	34.5	01/06/2016	59.6
12/07/2015	69.0	12/23/2015	34.3	02/19/2021	58.9
12/09/2015	66.7	12/28/2015	55.5		
1-day P ₉₉ = 87.8 µg/L					
4-day P ₉₉ = 68.8 µg/L					
30-day P ₉₉ = 58.4 µg/L					

The data above is still considered to be representative since there have been no changes in operation. Therefore, using the 1-day P₉₉ above (87.8 µg/L) compared to the acute limit (254 µg/L), there is no reasonable potential for the effluent concentration to exceed the calculated acute limit (n=14). **No limits for zinc are required; however, monitoring at a frequency to ensure that a minimum of 11 samples are available at the next permit**

issuance is recommended since values consistently exceed 50 µg/L.

Mercury – The current permit requires quarterly monitoring of the influent and effluent for total recoverable mercury. A total of 18 effluent results are available from July 2017 through October 2021 for total recoverable mercury. The average concentration was 0.79 ng/L, and the maximum was 2.3 ng/L. Because the 30-day P₉₉ of available data (1.0 ng/L) is less than the most stringent WQBEL of 1.3 ng/L, **no WQBEL for mercury is required for permit reissuance. Quarterly mercury monitoring is recommended to continue for permit reissuance**, consistent with other major municipal dischargers.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. Given the fact that the Wisconsin Dells-Lake Delton Sewerage Commission WWTF does not currently have ammonia nitrogen limits, the need for limits is evaluated at this time.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

Daily maximum limitations are based on acute toxicity criteria in ch. NR 105, Wis. Adm. Code, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation:

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - \text{pH})})] + [B \div (1 + 10^{(\text{pH} - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warm Water Sport fishery, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 1675 sample results were reported from May 2017 through November 2021. The maximum reported value was 7.7 s.u. (Standard pH Units). The effluent pH was 7.5 s.u. or less 99% of the time. The 1-day P₉₉, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 7.5 s.u. The mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 7.5 s.u. Therefore, a value of 7.5 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 7.5 s.u. into the equation above yields an ATC = 19.9 mg/L.

Potential Changes to Daily Maximum Ammonia Nitrogen Effluent Limitations

Subchapter IV of ch. NR 106, Wis. Adm. Code (effective September 1, 2016) specifies methods for the use of the 1-Q₁₀ receiving water low flow to calculate daily maximum ammonia nitrogen limits if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits shall apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1-Q₁₀ (estimated as 80 % of 7-Q₁₀) and the 2×ATC approach are shown on the next page. The 2×ATC method yields the most stringent limits for Wisconsin Dells-Lake Delton Sewerage Commission WWTF.

Attachment #1

Daily Maximum Ammonia Nitrogen Determination

	Ammonia Nitrogen Limit (mg/L)
2×ATC	40
1-Q ₁₀	6749

Presented below is a table of daily maximum limitations corresponding to various effluent pH values updated using the 1-Q₁₀. Use of this table is not necessarily recommended in the permit, but it is presented herein for informational purposes.

Daily Maximum Ammonia Nitrogen Limits – WWSF

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
6.0 ≤ pH ≤ 6.1	108	7.0 < pH ≤ 7.1	66	8.0 < pH ≤ 8.1	14
6.1 < pH ≤ 6.2	106	7.1 < pH ≤ 7.2	59	8.1 < pH ≤ 8.2	11
6.2 < pH ≤ 6.3	104	7.2 < pH ≤ 7.3	52	8.2 < pH ≤ 8.3	9.4
6.3 < pH ≤ 6.4	101	7.3 < pH ≤ 7.4	46	8.3 < pH ≤ 8.4	7.8
6.4 < pH ≤ 6.5	98	7.4 < pH ≤ 7.5	40	8.4 < pH ≤ 8.5	6.4
6.5 < pH ≤ 6.6	94	7.5 < pH ≤ 7.6	34	8.5 < pH ≤ 8.6	5.3
6.6 < pH ≤ 6.7	89	7.6 < pH ≤ 7.7	29	8.6 < pH ≤ 8.7	4.4
6.7 < pH ≤ 6.8	84	7.7 < pH ≤ 7.8	24	8.7 < pH ≤ 8.8	3.7
6.8 < pH ≤ 6.9	78	7.8 < pH ≤ 7.9	20	8.8 < pH ≤ 8.9	3.1
6.9 < pH ≤ 7.0	72	7.9 < pH ≤ 8.0	17	8.9 < pH ≤ 9.0	2.6

Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)

Due to the available dilution in the receiving water, calculated weekly and monthly limits are much greater than the maximum effluent concentration of 6.7 mg/L (the lowest calculated weekly or monthly limit being 465 mg/L) and are therefore not considered further. The calculated limits are presented in Attachment #3.

Effluent Data and Recommendations

Ammonia nitrogen was sampled twice per month from January 2020 through December 2020. Out of 24 samples, only 10 samples were detected. A minimum of 11 detected results are needed to calculate the 99th upper percentile (or P₉₉) values. Since there are fewer than 11 results, the mean is used to compare against the calculated limits in order to determine the need to include ammonia limits. The detected results are shown in the table below.

Ammonia Nitrogen Data

Sample Date	Ammonia Nitrogen mg/L	Sample Date	Ammonia Nitrogen mg/L	Sample Date	Ammonia Nitrogen mg/L
1/20/2020	6.7	3/9/2020	4.2	12/7/2020	1.4
1/27/2020	3.9	6/8/2020	4.2	12/21/2020	4.3
2/3/2020	4.0	9/7/2020	0.57		
2/17/2020	15	10/19/2020	0.51		
Mean* = 1.9 mg/L					

*14 samples with values lower than the level of detection (not shown in the table) were substituted with a zero when calculating the mean.

Based on the comparison of the mean to the calculated limits, there is no reasonable potential for the discharge to exceed any of the calculated ammonia nitrogen limits. **No limits are needed; however, monitoring is recommended in the fourth year of the permit term.**

PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR BACTERIA

On May 1, 2020, revisions to chs. NR 102 and NR 210, Wis. Adm. Codes, became effective which replace fecal coliform limits with new *Escherichia coli* (*E. coli*) limits for protection of recreational uses. Section NR 210.06(2)(a)1, Wis. Adm. Code, includes two limits which must be included in permits for facilities which are required to disinfect:

1. The geometric mean of *E. coli* bacteria in effluent samples collected in any calendar month may not exceed 126 counts/100 mL.
2. No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 counts/100 mL.

E. coli monitoring is recommended at the same frequency that fecal coliform monitoring is required in the current permit. Since Wisconsin Dells-Lake Delton Sewerage Commission WWTF's permit requires weekly monitoring, the 410 counts/100 mL limit will effectively function as a daily maximum limit unless the facility performs additional monitoring. Any additional monitoring beyond what is required by the permit must also be reported on the DMR as required in the standard requirements section of the permit.

These limits are required during May through September. No changes are recommended to the current recreational period and the required disinfection season.

Interim Limit

At this time, there is no effluent *E. coli* data available to determine if these limits are currently met. The permit will include a compliance schedule to meet these limits. During the compliance schedule, an interim limit applies to prevent back-sliding from the current level of disinfection during the compliance schedule period. Therefore, the current **fecal coliform limit shall be included in the reissued permit as an interim limit of 400 counts/100 mL as a monthly geometric mean.** The weekly geometric mean limit, which was included in the current permit for expression of limits purposes, does not need to be included in the permit as an interim limit.

PART 5 – PHOSPHORUS

Technology-Based Effluent Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of total phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Since Wisconsin Dells-Lake Delton Sewerage Commission WWTF currently has a limit of **1.0 mg/L, this limit should be included in the reissued permit.** This limit remains applicable unless a more stringent WQBEL is given.

In addition, the need for a WQBEL for phosphorus must be considered.

TMDL Limits – Phosphorus

Total phosphorus (TP) effluent limits in lbs/day are calculated as recommended in the *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs* (May 2020). The wasteload allocations (WLA) that implement site-specific criteria for Lakes Petenwell, Castle Rock, and Wisconsin are found in Appendix K of the *Total Maximum Daily Loads for Total Phosphorus in the Wisconsin River Basin (WRB TMDL)* report dated April 26, 2019 and are expressed as maximum annual loads (lbs/year) and maximum daily loads (lbs/day). The WLA that implement statewide criteria found in Appendix J of the TMDL report are no longer applicable following approval of these site-specific criteria. The daily WLAs in the WRB TMDL equals the annual WLA divided by the number of days in the year. Therefore, the daily WLA is an annual average. Since the derivation of daily WLAs from annual WLAs does not take effluent variability or monitoring frequency into consideration, maximum daily WLAs from the WRB TMDL should not be used directly as permit effluent limits.

For the reasons explained in the April 30, 2012 paper entitled *Justification for Use of Monthly, Growing Season and Annual Average Periods for Expression of WPDES Permit Limits for Phosphorus Discharges in Wisconsin*, WDNR has determined that the phosphorus WQBELs set equal to WLAs would not be consistent with the assumptions and requirements of the TMDL.

Therefore, limits given to continuously discharging facilities covered by the WRB TMDL are given monthly average mass limits. If the equivalent effluent concentration is less than or equal to 0.3 mg/L, six-month average mass limits are also included. The following equation shows the calculation of equivalent effluent concentration:

$$\begin{aligned}\text{TP Equivalent Effluent Concentration} &= \text{Daily WLA} \div (\text{Flow Rate} * \text{Conversion Factor}) \\ &= 8 \text{ lbs/day} \div (2.73 \text{ MGD} * 8.34) \\ &= 0.35 \text{ mg/L}\end{aligned}$$

Since this value is greater than 0.3 mg/L, the WLA should be expressed as a monthly average mass limit for total phosphorus, and no six-month average limit is required.

$$\begin{aligned}\text{TP Monthly Average Permit Limit} &= \text{daily WLA} * \text{monthly average multiplier} \\ &= 8 \text{ lbs/day} * 1.72 \\ &= 14 \text{ lbs/day}\end{aligned}$$

The multiplier used in the monthly average calculation was determined as recommended in TMDL implementation guidance. A coefficient of variation was calculated, based on phosphorus mass monitoring data, to be 1.2. The facility is able to meet the permit limits based on the WLA, so the current CV is used. This value, along with monitoring frequency, is used to select the multiplier. The current permit specifies phosphorus monitoring as three times per week in the off season and five times per week during June through August. The proposed monitoring frequency is five times per week year-round and so this frequency was used to determine the multiplier. If a different monitoring frequency is used, the stated limits should be re-evaluated. For informational purposes, the mass limit of 14 lbs/day equates to an approximate concentration of 0.61 mg/L ($14 \text{ lbs/day} \div (2.73 \text{ MGD} \times 8.34)$).

The WRB TMDL establishes TP wasteload allocations to reduce the loading in the entire watershed including WLAs to meet water quality standards, for tributaries to the Wisconsin River. Therefore, WLA-based WQBELs are protective of immediate receiving waters and TP WQBELs derived according to s. NR 217.13, Wis. Adm. Code are not required.

Attachment #1

Since wasteload allocations are expressed as annual loads (lbs/yr), permits with TMDL-derived monthly average permit limits should require the permittee to calculate and report rolling 12-month sums of total monthly loads for TP. Rolling 12-month sums can be compared directly to the annual wasteload allocation.

Total Phosphorus Data

	Concentration mg/L	Mass Discharge ** lbs/day
1-day P ₉₉	0.85	10
4-day P ₉₉	0.46	5.4
30-day P ₉₉	0.24	2.8
Mean	0.15*	1.8
Std	0.18	2.1
Sample Size	844 (2 ND)	844
Range	<0.03 - 1.9	0 - 24

* Results below the level of detection (ND) were included as zeroes in calculation of average.

** Mass was not reported so the values are calculated based on the actual flow for that day.

Recommendations

In summary, the following limits are recommended by this evaluation:

- Monthly average Total Phosphorus mass limit of 14 lbs/day
- Monthly average Total Phosphorus concentration limit of 1.0 mg/L

**PART 6 – WATER QUALITY-BASED EFFLUENT LIMITATIONS
FOR THERMAL**

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

Due to the amount of upstream flow available for dilution in the limit calculation ($Q_s:Q_e > 20:1$), the lowest calculated limitation is 120° F (s. NR 106.55(6)(a), Wis. Adm. Code). There is no reasonable potential for the discharge to exceed this limit; therefore, **no limits or monitoring are recommended**.

PART 7 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional judgment of staff familiar with the discharge after consideration of the guidance in the *Whole Effluent Toxicity (WET) Program Guidance Document* (October 29, 2019).

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure.

Attachment #1

To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC₅₀ (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09(2)(b), Wis. Adm Code.

- Chronic testing is usually not recommended where the ratio of the 7-Q₁₀ to the effluent flow exceeds 100:1. For the Wisconsin Dells-Lake Delton Sewerage Commission WWTF, that ratio is approximately 106:1. With this amount of dilution, there is believed to be little potential for chronic toxicity effects in the Wisconsin River associated with the discharge from the Wisconsin Dells-Lake Delton Sewerage Commission WWTF, so **the need for chronic WET testing will not be considered further.**
- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.
- Shown below is a tabulation of all available WET data for Outfall 001. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08(3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations.

Tests conducted prior to 2005 are not presented in the table below due to significant changes that were made to WET test methods in 2004. These changes were assumed to be fully implemented by certified labs by no later than June 2005. Data collected before July 1, 2005 does not show repeated toxicity that was never resolved and is not the only data that is available.

WET Data History

Date Test Initiated	Acute Results LC ₅₀ % (% survival in 100% effluent)				Footnotes or Comments
	<i>C. dubia</i>	Fathead minnow	Pass or Fail?	Used in RP?	
10/25/2006	>100	>100	Pass	Yes	
07/18/2007	>100	>100	Pass	Yes	
01/15/2008	>100	>100	Pass	Yes	
02/04/2009	>100	>100	Pass	No	1
10/20/2010	>100	>100	Pass	No	1
07/27/2011	>100	>100	Pass	Yes	
01/10/2012	>100	>100	Pass	Yes	
07/23/2014	>100	>100	Pass	Yes	
05/27/2015	>100	>100	Pass	Yes	
10/11/2017	>100	>100	Pass	Yes	
08/15/2018	>100	>100	Pass	Yes	
04/24/2019	>100	>100	Pass	Yes	
03/04/2020	>100	>100	Pass	Yes	

1. Tests done by S-F Analytical, July 2008 – March 2011. The DNR has reason to believe that WET tests completed by SF Analytical Labs from July 2008 through March 31, 2011 were not performed using proper test methods. Therefore, WET data from this lab during this period has been disqualified and was not included in the analysis.

Attachment #1

- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.

According to s. NR 106.08(6)(d), Wis. Adm. Code, TUa and TUC effluent values are equal to zero whenever toxicity is not detected (i.e., when the LC₅₀, IC₂₅ or IC₅₀ ≥ 100%).

Acute Reasonable Potential = 0 < 1.0, **reasonable potential is not shown, and a limit is not required.**

The WET checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other related permit conditions. The checklist indicates whether acute and chronic WET limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code. The checklist steps the user through a series of questions, assesses points based on the potential for effluent toxicity, and suggests monitoring frequencies based on points accumulated during the checklist analysis. As toxicity potential increases, more points accumulate, and more monitoring is recommended to ensure that toxicity is not occurring. A summary of the WET checklist analysis completed for this permittee is shown in the table below. Staff recommendations based on best professional judgment are provided below the summary table. For guidance related to reasonable potential and the WET checklist, see Chapter 1.3 of the WET Guidance Document: <https://dnr.wisconsin.gov/topic/Wastewater/WET.html>.

WET Checklist Summary

	Acute
AMZ/IWC	Not Applicable. 0 Points
Historical Data	11 tests used to calculate RP. No tests failed. 0 Points
Effluent Variability	Little variability, no violations or upsets, consistent WWTF operations. 0 Points
Receiving Water Classification	WWSF 5 Points
Chemical-Specific Data	No limits based on ATC; ammonia, chloride, chromium, mercury, nickel, and zinc detected. Additional Compounds of Concern: Hexachlorobenzene detected. 5 Points
Additives	No Biocides and one Water Quality Conditioner (alum) added. P treatment chemical other than Ferric Chloride (FeCl ₃), Ferrous Sulfate (FeSO ₄), or alum used: No. 1 Point
Discharge Category	No industrial contributors. 0 Points
Wastewater	Secondary or Better

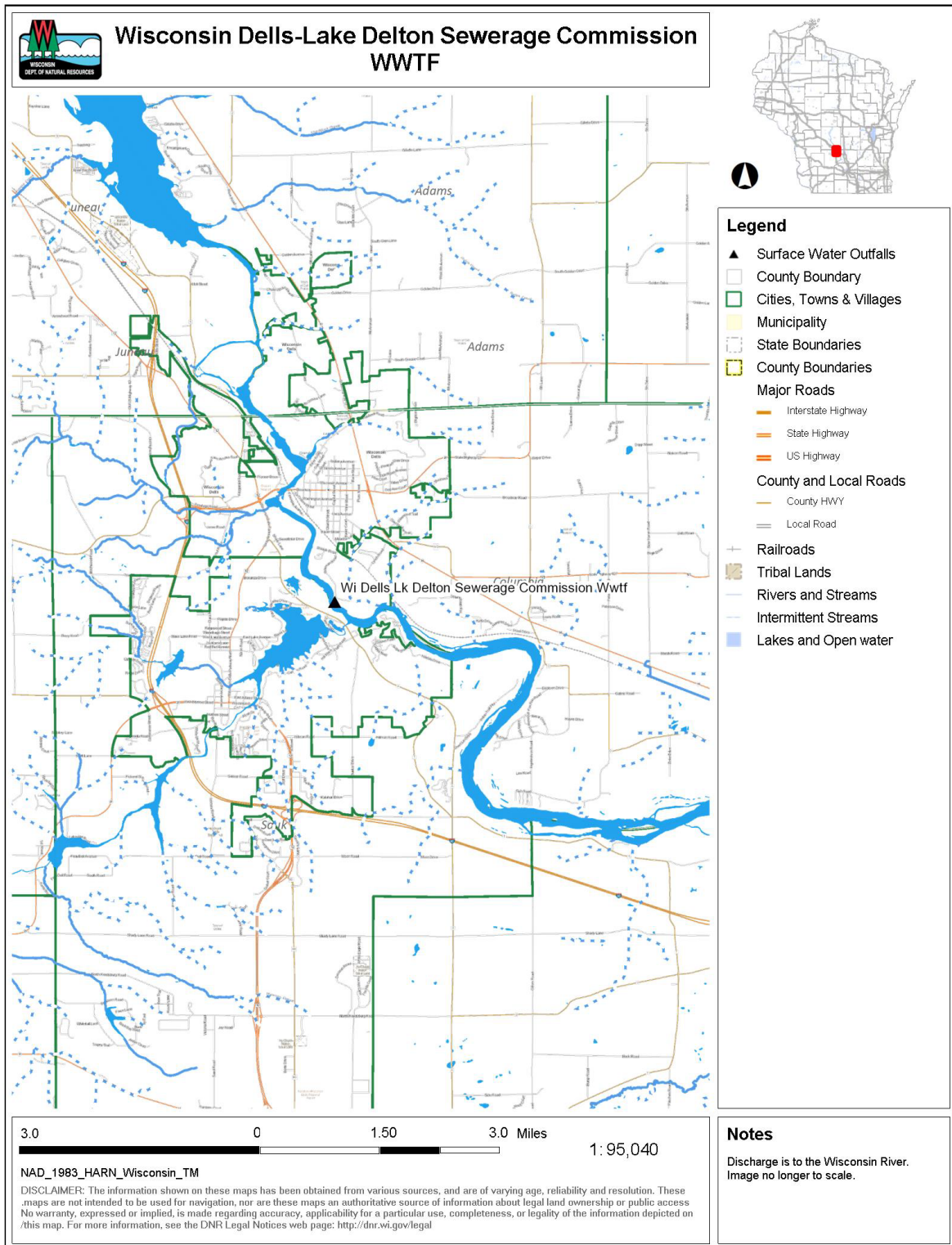
Attachment #1

	Acute
Treatment	0 Points
Downstream Impacts	No impacts known. 0 Points
Total Checklist Points:	11 Points
Limit Required?	No
TRE Recommended? (from Checklist)	No

Recommendations

A minimum of annual acute monitoring is recommended because the Wisconsin Dells-Lake Delton Sewerage Commission WWTF is a major municipal discharger with a design flow greater than 1.0 MGD. Federal regulations at 40 CFR Part 122.21(j) require at least four acute and chronic WET tests with each permit application on samples collected since the previous reissuance. The federal requirement for annual chronic WET tests is not applicable in this case due to the amount of dilution. Therefore, **annual acute and no chronic WET tests are recommended in the reissued permit. Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).**

Attachment #2 Site Map



Ammonia Nitrogen Calculations from the WQBEL Memo Dated June 16, 2009

AMMONIA (as N) LIMITS		WARMWATER SPORTFISH COMMUNITY		
CLASSIFICATION:				
EFFLUENT FLOW (mgd):	2.73			
EFFLUENT FLOW (cfs):	4.224			
MAX. EFFLUENT pH (s.u.):	7.46			
BACKGROUND INFO:		<i>May-Sept.</i>	<i>Oct.-March</i>	<i>April</i>
7Q10 (cfs)	1790	1790	1790	1790
30Q5 (cfs)	2337.5	2337.5	2337.5	2337.5
7Q2 (cfs)	2750	2750	2750	2750
Ammonia (mg/L)	0.06	0.12	0.06	0.06
Temperature (deg C)	25	5	9	
pH (std. units)	8.21	7.97	7.97	
% of river flow used:	100	25	50	
Reference weekly flow:	1790	447.5	895	
Reference monthly flow:	2337.5	584.375	1168.75	
CRITERIA (in mg/L):				
4-day Chronic (@ backgrd. pH):				
early life stages present	2.24	6.35	6.35	
early life stages absent	2.24	10.31	9.06	
30-day Chronic (@ backgrd. pH)				
early life stages present	0.90	2.54	2.54	
early life stages absent	0.90	4.12	3.63	
EFFLUENT LIMITS (in mg/L):				
Weekly average				
early life stages present	927.98	666.40	1339.17	
early life stages absent		1090.01	1916.87	
Monthly average				
early life stages present	464.53	337.36	688.77	
early life stages absent		558.14	990.20	

Note: Early life stages present limits apply during the months of April through September and the early life stages absent limits apply to October through March for warm water sport fish community streams where burbot are not expected to be present.